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EDITORIAL

Electronic Publishing

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As a result of actions taken at the 2002 Fall Meeting, a committee of the Council set out to review AGU's transition to electronic publications (as described in an e-mail message sent to all members on 11 January 2003). We wanted to understand what was not functioning well, and also what was improving from the perspective of the membership. By providing an in-depth understanding of the program to the membership and to the rest of the Council, we would be better able to recommend changes to existing policy and guide policy directions in the future.

We have found that the journals program suffered in many ways as a result of the significant changes brought on by the transition to electronic publishing. Most of the problems can be attributed to the challenges of converting a system that depended on author-produced copy on paper to character-based electronic delivery. No other society of our size has made this kind of transition. The switch from the low-technology approach that had served the membership so well was a wrenching one. Staff recommended from the outset that it would be more efficient to do all journals at once, and to incorporate all aspects of the long-awaited transition (such as making the dynamic content an integral part of the journals).

Thus, AGU decided that there would be a single transition. In retrospect, it seems rather evident that small steps might have been better than one big leap. However, our Committee has learned that rolling back the process now would create a second wave of major disruptions to journal production. Much progress has already been made, some of which has been reported in *Eos*. Nonetheless, there are still major issues to be addressed; these include library access, costs to authors, and effective citations.

About 600 members and librarians accepted our invitation to provide comments. Our thanks go to all who took the time to respond, especially to those who gave specific information about personal experiences. These comments were especially useful in our assessment of the current situation and how things have changed over the last ~16 months. In addition to e-mail from members, we had survey results from more than 1500 authors who had articles published during 2002 and 2003, and from about 400 authors who had used the electronic submission system in the early part of 2002 and the last two months of 2002. These surveys were initiated by the Publications Committee and will continue, as a way to measure author satisfaction and point to areas that need further attention.

As part of a selected sample, 600 members were asked about their experiences as readers. In these surveys, members compared AGU journals with another journal of the respondent's choice. Similar surveys had been done for JGR-Solid Earth and *Water Resources Research* in 1996 and 1999, respectively. Thus, we could compare how perceptions had changed. Basically, readers are somewhat more pleased with AGU journals today than in the past. About 300 members with electronic-only subscriptions were asked to evaluate the functionality of AGU's online journals and to help prioritize enhancements being considered.

First, some of the good news. There are places in which progress has been made:

• The inventory of unpublished articles has dropped by about 40% since last spring. The very slow rate of publication in the first half of 2002 has turned around, and the total number of articles expected to be published last year were published by year-end. In 2003, publication is running about 40% ahead of expected levels. Author surveys show that in January-May 2002 less than 45% thought promptness of copy-editing was excellent or good, and in January-February 2003 more than 55% gave the same marks.

• The handling of math in early 2002 was especially problematic, because different browsers do not render non-ASCII in the same way. Once the problem was identified, special characters were coded by their numeric entities, which are treated consistently across browsers. Handling math-heavy articles is still a challenge, but a major area of dissatisfaction has been resolved.

• Being unable to track progress (or, more important, lack thereof) after acceptance created considerable author discomfort, even anxiety. Since December, authors have been able to check current status via a Web form.

• Printed issues have been unacceptably slow since the first quarter of last year. This slowness has been a major drawback because of the large number of institutions that had no electronic access; not even the free in-library single seat. Staff report that printed issues will be on schedule no later than the May 2003 issues. Mail dates are reported weekly in *Eos*.

Progress has been possible because of patience and support of authors, reviewers, and Editors during the transition, and because of the hard work and diligence of the headquarters staff.

There is still much to be done before the Union can declare the transition a success. We identified six key areas for attention:

Access: We conclude that the first and foremost priority is to have the widest possible access to authors' works through libraries or directly by individuals. Several plans are underway to enhance access. Details will be announced to libraries and in *Eos* in the next several weeks. In addition to increasing desktop access, we must see the records of ISI (Institute for Scientific Information) brought up to date and kept that way.

Costs to authors: Staff have been charged with finding where leverage can be applied for reducing the publication fees, while improving accuracy in converting electronic files, reducing manual intervention, and increasing speed of publication. They will then capitalize on those findings. In addition, communication about the current policy is to be improved so that authors are not turned off because of misunderstandings about areas such as which fees are mandatory. Furthermore, it should be made simple for authors to project costs at the time they are preparing their articles, when it is easiest to control the length.

Functionality: It must be easier for readers to get to current and back issue articles and dynamic material related to articles. The library of electronic back issues should become a more useful asset for readers. A greater number of interested and knowledgeable members should be engaged in testing new and upgraded functions.

Production: Preparation of figures in acceptable formats continues to be a problem area. The Information Technology Committee has agreed to help improve this aspect of production.

Effective citations: The citation style should be revised to make it easier to find items in both the print and electronic formats. This change is to be effective with articles published on or after 1 January 2004 and must work with ISI requirements. Re-introduction of sequential

page numbers (which have little meaning in the online environment, hence were eliminated) is not needed as long as the way to find articles from their citations is improved. The machine-readable doi format need not be changed if a more "human-friendly" citation, which incorporates information about publication date of volume, and perhaps length of article, exists.

Measuring improvement: Quantitative measures of improvement need to be available to Council, the Publications Committee, and the managers at headquarters. Several types of data have been identified. Some, such as the overall timeliness statistics, will be reported on the Web for the entire membership.

Staff immediately began working on some of the specific suggestions of our Committee and have begun implementation plans for the rest, to which the Publications and Information Technology Committees will contribute. Progress will be reported by these committees to Council and to you via *Eos*. When these issues are resolved, we believe that the AGU publications program will be second to none.

Our interim report was discussed by the rest of the Council during the Joint Assembly in Nice on 6 April 2003. Minor modifications to the course of action resulted from this input. The report and some related background can be found at www.agu.org/pubs/review.

The Union owes a debt of gratitude to authors and readers who steadfastly stuck it out during this major and oftentimes rocky transition. Their willingness to be pioneers and to provide constructive criticisms and encouragement are important ingredients in the progress made to date. To those authors who have had bad experiences, we offer sincere apologies and ask that you give AGU a chance to show that things have improved and will continue to do so. As members of the AGU Council, we will strive to assure that the Union's journals remain on a good track, and that AGU continues its tradition of being the world's premier society in the geophysical sciences.

—DANIEL N. BAKER, President, SPA Section

On behalf of the Council Publication Review Committee: Daniel. N. Baker, Chair; Guy Brasseur (AS); Veronique Dehant (G); Christopher Harrison (GP); Michael McPhaden (OS); Gerald Schubert (P); Paul Silver (S); Leslie Smith (H); David Stevenson (P); Lisa Tauxe (GP)

Phosphorus Deficiency in the Atlantic: An Emerging Paradigm in Oceanography

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BY JAMES W. AMMERMAN, RALEIGH R. HOOD, DARIN A. CASE, AND JAMES B. COTNER

Nitrogen, iron, and silica are widely considered to be the most important nutrients that limit phytoplankton growth in the world's oceans. Though clearly important in lakes, the role of phosphorus has been largely ignored in the ocean. In part, this is because of early studies that suggested there was excess phosphate (P) relative to the needs of the phytoplankton in open ocean waters. Thanks to recent studies at the Hawaiian Ocean Time (HOT) series station (Station ALOHA) in the North Pacific subtropical gyre [*Karl et al.*, 2001, and references therein], there is a growing appreciation of the potential importance of phosphorus as a limiting nutrient in subtropical Pacific waters.

However, in spite of the fact that there is substantial evidence of phosphorus deficiency, relative to nitrogen [N], in subtropical Atlantic waters, and obvious reasons for this deficiency, many oceanographers do not appreciate the potential importance of phosphorus as a limiting nutrient in the Atlantic Ocean. If we wish to understand the factors that control primary production in the Atlantic, both now and in the future as the oceans respond to global warming, then we must consider phosphorus, as well as nitrogen, iron, and silica. The central goal of this article is to summarize and further emphasize the growing body of evidence that indicates the potential importance of phosphorus as a limiting nutrient in the Atlantic Ocean.

The degree to which the oceans are either nitrogen- or phosphorus-limited is ultimately determined by the balance between nitrogen fixation, which converts atmospheric dinitrogen gas into forms that can be utilized by phytoplankton; and denitrification, which converts reactive nitrogen back into gaseous forms. *Karl et al.* [2001] have hypothesized that changes in climate over the last few decades have resulted in more stable (stratified) conditions in the subtropical Pacific that favor organisms that fix nitrogen. This, in turn, has increased the size of the nitrogen pool and pushed the system toward phosphorus limitation [*Karl et al.*, 2001].

Regardless of changes in climate, there is reason to believe that rates of nitrogen fixation, and therefore the potential for phosphorus limitation, are much higher in the Atlantic Ocean than in the Pacific. Both direct rate estimates [*Capone et al.*, 1997] and geochemical evidence [*Gruber and Sarmiento*, 1997] suggest that the lion's share of the nitrogen fixation in the world's oceans occurs in the Atlantic. These elevated rates may be linked to atmospheric iron deposition; i.e., it is believed that rates of open ocean nitrogen fixation are limited by the availability of iron due to the high iron requirement of the enzyme nitrogenase, which converts dinitrogen gas to ammonium. There is much more atmospheric dust and iron deposition in the Atlantic than in the Pacific [*Husar et al.*, 1997].

Studies at BATS: Chemistry

To evaluate the potential for phosphorus limitation in the Atlantic, we have measured phosphate availability as well as rates of phosphorus assimilation by the plankton. These measurements were made at the Bermuda Atlantic Time Series (BATS) station in the northwestern Atlantic (Sargasso Sea), and have been compared to other ecosystems. Mean vertical profiles of soluble reactive phosphorus (SRP, also known as dissolved inorganic phosphorus, orthophosphate, or just phosphate), dissolved organic phosphorus (DOP), and particulate phosphorus (PP) over a 2-year monthly time series are shown in Figure 1 [*Case*, 2001]. This figure shows very low concentrations of all three phosphate pools. All three pools have lower concentrations than observed at the HOT station [*Cavender-Bares et al.*, 2001; *Karl et al.*, 2001; *Wu et al.*, 2000]. The soluble reactive phosphorus concentrations (15 nmol l^{-1} or less at the surface, Figure 1) approach the low values in the eastern Mediterranean, which is currently the site of an intensive study of phosphorus limitation. Soluble reactive phosphate concentrations to the south of BATS are even lower, just a few nanomoles per liter [*Cavender-Bares et al.*, 2001; *Wu et al.*, 2000].

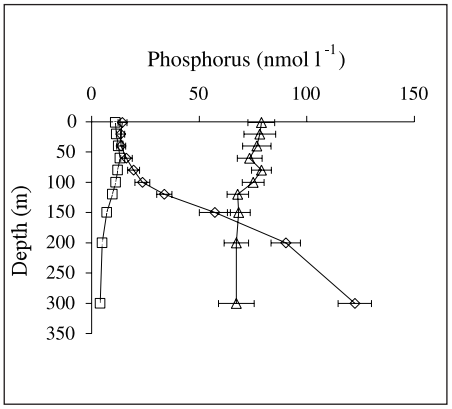

Fig. 1. Mean profiles (± std. error) of soluble reactive phosphorus (diamonds, SRP), dissolved organic phosphorus (triangles, DOP), and particulate phosphorus (squares, PP) at BATS based on 2 years (1995–1997) of monthly time-series samples [Case, 2001].

Phosphorus deficiency is suggested by the N:P ratios in all of the inorganic and organic matter pools (both dissolved and particulate) in the upper ocean in the subtropical northwestern Atlantic [*Cavender-Bares et al.*, 2001; *Gruber and Sarmiento*, 1997; *Michaels et al.*, 2001; *Wu et al.*, 2000; and data presented here]. Thus, there is great potential for phosphorus limitation of phytoplankton and bacterial growth in this region. The classical Redfield elemental ratio for healthy phytoplankton is 106 carbon (C):16N:1P. Using high-sensitivity nutrient analysis methods, the ratio of nitrate-